much higher concentrations. Concentrations of isoprene and terpene emitted from *Mango* and *Eucalyptus* were significantly greater than emissions from other species. Isoprene emissions from *Avocado* were greater than from *Pine* and *Eucalyptus* whereas terpene emissions were highest from *Mango* and *Avocado*. Leaf level emissions of the isoprene and terpenes (α-pinene, β-pinene, α-terpinene, linalool and limonene) were also measured using a leaf cuvette in combination with a gas chromatograph. The experimental design as well as initial results will be presented in the poster.

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National Plant Collecting Programme: Is it worth the trouble? Progress on collection in Tankwa Karoo and Namaqua National Parks

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The National Plant Collecting Programme (NPCP) uses the PRE Computerised Information System (PRECIS) database to identify areas of poor specimen representation at the National Herbarium (PRE) and then target them for collection. In 2004 a facet under the NPCP was registered as a long-term project within all South African National Parks (SANParks) to focus specifically on the aims of the NPCP within the enlarging SANParks. This poster compares the state of the holdings at PRE before commencement of the project (December 2003) with the state after three collecting expeditions to Namaqua National Park (2004–2006) and two trips to Tankwa Karoo National Park (2004 and 2006). General collecting increases our understanding of plant biogeography, assists in solving taxonomic problems and increases the predictive value of plant distributions in the PRECIS database. In Namaqua National Park 161 and in Tankwa Karoo National Park 357 new records were added to PRE. Our focused collection over two years contributed more to the botanical knowledge of the Tankwa Karoo National Park than other collections had contributed over the previous 100 years. In the Namaqua National Park the impact was less because of more extensive collecting in the past.

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Diverse beta-rhizobia nodulate the indigenous genus *Hypocalyptus* and related genera of the tribe Podalyrieae

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The monogeneric tribe Hypocalypteae (subfamily Papilionoideae) includes three species, *Hypocalyptus sophoroides*, *H. oxalidifolius* and *H. coluteoides*, all of which are restricted to the Cape floristic region. They share some characteristics with members of the largely indigenous tribe Podalyrieae. Like most papilionoid legumes, the Hypocalypteae and Podalyrieae are involved in nitrogen-fixing symbioses with rhizobial bacteria. Within the Podalyrieae, some *Cyclopia* species are known to be nodulated by so-called beta-rhizobia, which are mostly represented by the Beta-Proteobacteria genus *Burkholderia*. Our aim was to determine whether *Hypocalyptus* species and the Podalyrieae genera *Podalyria* and Virgilia are also nodulated by beta-rhizobia. For this purpose, bacteria were isolated from the root nodules of the *Hypocalyptus* species, as well as *Virgilia oroboides* and *Podalyria calyptrata*. For each isolate, the 16S ribosomal RNA gene was amplified, sequenced and subjected to phylogenetic analyses to obtain putative identifications. Our results showed that all the examined bacteria indeed represent *Burkholderia* species, some which were most closely related to type-strains of known nitrogen-fixers (e.g. *B. xenovorans*) and/or nodulators (e.g. *B. phymatum* and *B. tuberum*). However, the majority of isolates from the *Hypocalyptus* species, *V. oroboides* and *P. calyptrata* root nodules represent novel lineages of *Burkholderia*. Taken together, these data indicate that diverse *Burkholderia* species are likely to also nodulate other *Virgilia* and *Podalyria* species and that the root nodules of indigenous legumes probably represent unexplored reservoirs of vast beta-rhizobial diversity.

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Response of indigenous legumes of the Cape Floristic Region to P supply

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Plants growing in nutrient-impoverished soils of the Cape Floristic Region (CFR) are adapted to low levels of P. The fabaceae (legumes) are the second largest family in the CFR with 760 species. The effect of different levels of P supply was investigated on seven indigenous legumes: *Crotalaria capensis*, *Indigofera frutescens*, *Indigofera lyalli*, *Lessertia frutescens*, *Podalyria calyptrata*, *Psoralea pinnata* and *Tephrosia grandiflora* grown in hydroponics. The plants were subjected to four levels of P: 1, 10, 100, and 250 μM P. Six species received 1/s dilution Hoagland nutrient solution and 0.5 mM N, while *C. capensis* received a 1/4 dilution. Plants were harvested at 65 d after exposure to P-treatments and assessed for dry matter yield, concentration of total non-structural carbohydrates (TNC) and tissue nutrients. The results showed that biomass accumulation in response to the levels of P whether on whole-plant or per organ basis varied with legume species. The highest level of P (250 μM P) stimulated whole-plant growth of *C. capensis* and *I. frutescens* but decreased growth of *P. calyptrata* relative to plants receiving 1 μM P. Similarly, supplying the plants with 100 μM P stimulated growth of *I. lyalli* and *L. frutescens* where as 10 μM P increased growth of *T. grandiflora*. In contrast, growth of *P. pinnata* was not affected by P supply suggesting that this species is not sensitive to P supply or the P levels were not high enough to stimulate growth response. The effect of P levels on concentration of TNC and nutrients in the tissue were discussed. The results suggest that there was wide variation of plant response to P-levels in hydroponically grown plants such that increased P supply enhanced plant growth in some legume species.

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The salicylic acid signalling pathway confers tolerance to a biotrophic rust pathogen in pearl millet

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Studies were undertaken to assess induction of defence response pathways in the indigenous African crop, pearl millet, in response to infection with the leaf rust fungus *Puccinia substriata*. Pathology studies indicated that pretreatment of pearl millet with salicylic acid (SA) conferred resistance to a virulent isolate of the rust fungus, whereas methyl jasmonate (MeJA) did not significantly reduce infection levels. These results suggest that the salicylic acid defence pathway is induced in response to rust infection. Large scale gene expression profiling was performed in order to contrast MeJA and SA responses in pearl millet, and identify transcripts that are uniquely expressed in response to SA treatment. Gene expression analysis revealed substantial overlap in gene expression responses between treatments, with MeJA and SA treatments exhibiting 75 coinduced transcripts. However there were 108 transcripts that were differentially expressed in response to SA treatment, but not in response to MeJA treatment. Sequence analysis indicated that these SA responsive transcripts included genes involved in SA biosynthesis, defence response, signal transduction, cellular detoxification in response to pathogens/oxidative burst, protein synthesis and photosynthesis, as well as transcripts

with no significant homology to sequences in the GenBank. Studies are currently underway to knockout the expression of a selection of SA induced genes in pearl millet in order to characterise their role in conferring tolerance to rust.

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Both root and shoot-derived factors plays a role in the chilling-induced inhibition of symbiotic nitrogen fixation in soybean

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Inhibition of symbiotic nitrogen fixation by chilling is a well-known phenomenon in soybean [*Glycine max* (L.) Merr.]. However, the mechanistic basis for this phenomenon, as well as genotypic variation in response intensity, has received limited attention. Nitrogenase activity and ureide content were examined in nodules of a chilling tolerant (Highveld Top) and sensitive (PAN809) genotypes exposed to dark chilling (6 °) under two sets of conditions, where both the shoots and roots were chilled (whole plant chilling, WPC), or where only the shoots were chilled (shoot chilling, SC). Following chilling stress, nitrogenase activity was inhibited by 55% and 94% for SC and WPC treatments respectively in PAN809, whereas in Highveld Top, activity was only reduced in the WPC treatment (80%). Upon rewarming during the day, inconsistent recovery of nitrogenase activity over time occurred in PAN809, compared to Highveld Top where complete recovery was obtained. The severe inhibition and lack of full recovery of nitrogenase activity led to larger reductions in nodule ureide content in the WPC treatment of PAN809 compared to the SC treatment. On a diurnal basis, ureide content in Highveld Top remained largely unaffected. Nodule sucrose levels, as well as sucrose synthase activity in PAN809 were not altered by chilling, indicating that changes in carbohydrate metabolism was not responsible for the loss of nitrogenase activity, but rather that chilling exerted direct effects on nitrogenase. However, moderate inhibition of nitrogenase activity in the SC treatment, also provided novel evidence supporting the involvement of some shoot-derived influence on nitrogenase activity.

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Does sodium chloride trigger the desiccation tolerance of *Eucalyptus grandis*?

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The hypothesis that exposure of *E. grandis in vitro* axillary buds to NaCl was associated with a cross triggering of tolerance to desiccation was tested. Shoots clusters were cultured on semi-solid medium with full-strength MS nutrient formulation (which contains 40 mM NO_3^- + 20 mM NH_4^+) and 0–150 mM NaCl, as well as modified semi- solid medium (40 mM NO_3 i.e. no NH_4^+) containing 0–150 mM NaCl. Axillary buds were isolated and dried over activated silica gel for 20–60 min. Shoot clusters were also cultured in the presence of abscisic acid (ABA [5 mg/l]), either as a pretreatment (5 days) or in combination with the standard/modified MS formulation (14 days). Results showed that as the NaCl concentration increased the *E. grandis* shoots showed increasing signs of stress. This was especially true for shoots cultured on the modified MS formulation. The addition of ABA as a pretreatment showed an increase in the number of shoot clusters that experienced no injury when cultured on the standard MS formulation, however, in the presence of the modified MS medium (40 mM NO_3) the injury increased. The addition of ABA to the nutrient medium with or without NH_4^+ (14 days) indicated that prolonged exposure to ABA had damaging effects, and this was exacerbated by the addition of NaCl. Hence, the hypothesis that NaCl acts as a cross trigger for desiccation tolerance can be rejected. Indeed *E. grandis in vitro* axillary buds are desiccation sensitive and exhibit avoidance characteristics in their response to water loss.

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Linking research to management: Restoring fynbos riparian vegetation following alien plant invasion

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Following global trends, invasive alien plants are becoming an increasingly large problem in South Africa where growing evidence links invasive alien plant transformation to declines in ecosystem integrity and services. Working for Water (WfW), with its combined aims to enhance ecological integrity, water security and social development, has been in operation since 1995. WfW has worked under the assumption that its focus ecosystems, mostly riparian, would "self repair" once the main stressor (dense stands of invasive alien trees) was removed. This assumption has been largely untested until now, and is the centre of our research on riparian vegetation management and ecosystem repair in alien plant-invaded landscapes in the Fynbos Biome. We asked 1) are the current alien-clearing practices achieving the ecosystem repair goals set by WfW to restore indigenous riparian vegetation structure, diversity and function? and 2) what are realistic restoration goals for these different situations? In tackling these questions, the aim was to identify best-practice techniques to ensure recovery after alien clearing and to produce guidelines and tools to improve management of these systems.

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Comparing plant species richness and functional diversity of natural and invaded subtropical grassland of Maputaland

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Sub-tropical grassland of the newly described Indian Ocean Coastal Belt Biome is generally considered to be anthropogenic. This grassland type is thought to be fire driven, and if fire is excluded it would probably revert to coastal forest or woodland. However, where the topsoil has been disturbed, these sites gradually become dominated by alien invasive species. Pioneer indigenous forest species are generally absent from these invaded areas. Indigenous plant species losses and functional diversity turnover per unit area was quantified for natural grassland previously transformed by alien plant invasions in the southern part of Maputaland. Thirty-two plots of 10 × 10 m were sampled at sixteen sites. At each site one plot was sampled in invaded grassland and one in natural grassland. Sixteen plots were sampled in Maputaland Wooded Grassland on dunes and sixteen in Maputaland Coastal Belt on hills. Thorough sampling of each plot during all seasons suggest, for instance, that natural sub-tropical coastal grassland has a mean indigenous species richness of 61 (n = 16) per 100 m^2. Invaded grassland have a mean species richness of 37 (n = 16) per 100 m^2. The functional diversity also changes after disturbance, with herb and graminoid dominated natural grassland becoming shrub and tree dominated. In addition, the mean number of Maputaland endemic plant species per sample plot is reduced from six in natural grassland to one in disturbed